

TFTs are disposed in a matrix and a source driver and a gate driver that drive the active matrix circuit;

an opposing substrate comprising an opposing electrode; and

a circuit which converts m bit digital video data inputted from the external into n bit digital video data and provides the n bit digital video data to the source driver, wherein m and n are positive numbers equal to or greater than 2 and satisfy $m > n$,

wherein the method of the liquid crystal display device is characterized as:

forming an image for one frame image comprising 2^{m-n} subframes by performing voltage gray scale method and time ratio gray scale that uses only (m-n) bit at the same time, and;

applying voltage which makes an orientation of liquid crystal to a bend orientation on starting display of the 2^{m-n} subframes.

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REMARKS

Applicants will now address each of the Examiner's objections and rejections in the order in which they appear in the Office Action.

Election/Restriction

As requested, Applicants affirm the election of Claims 1-30 and 49-54 to prosecute in the above-identified application. Applicants are making this election without prejudice to later filing a divisional application on the non-elected claims.

Information Disclosure Statement

In the Office Action, the Examiner states that the IDS filed "2/8/2002" fails to comply with 37 CFR §1.98(a)(2) requiring a copy of each reference. Applicants assume that this refers to the

IDS mailed on February 6, 2001. As shown on the return postcard (copy attached), Applicants did submit the references with the IDS. Perhaps they were lost between the PTO mail room and the Examiner. However, in order to advance the prosecution of this application, Applicants are preparing and will file a new copy of this IDS with references. It is requested that the Examiner not finish his examination of this application until he considers this IDS.

Specification

The Examiner objects to a misspelling on page 8, line 6 of the specification. Applicants have amended the specification to correct this typo.

Claim Rejections - 35 USC §112

The Examiner also rejects Claims 2, 4 and 6 under 35 USC §112, first paragraph, as containing subject matter which was not described in the specification in such a way as to enable one skilled in the art to which it pertains, or with which it is most nearly connected, to make and/or use the invention. In particular, the Examiner alleges that the specification only discloses that the voltage gray scale is first conducted and next time the ratio gray scale and cites page 8, lns. 20-21 in support thereof.

Applicants do not understand the Examiner's objection. However, in order to advance the prosecution of this application, Applicants have canceled Claims 2, 4 and 6 without prejudice. Accordingly, it is requested that this rejection be withdrawn.

Claim Rejections - 35 USC §103

Claims 1 and 2

The Examiner also rejects Claims 1 and 2 under 35 USC §103 as being unpatentable over Sasaki et al. in view of Nakai et al. This rejection is respectfully traversed.

Claim 1 requires:

“conducting voltage gray scale method and time ratio gray scale at the same time by using n bit out of m bit digital data as information for voltage gray scale, and only (m-n) bit as information for time ratio gray scale, wherein m and n are positive numbers equal to or greater than 2 and satisfy $m > n$ ”

Applicants respectfully submit that neither Sasaki nor Nakai teach or suggest using only (m-n) bit as information for the time ratio gray scale, as recited in amended Claim 1. Hence, this claim is not disclosed or suggested by the cited references. Therefore, since Claim 2 has been canceled, it is requested that this rejection be withdrawn.

Claims 19 and 20

The Examiner also rejects Claims 19 and 20 under 35 USC §103 as being unpatentable over Sasaki et al. in view of Nakai et al. and further in view of Mase et al. As Claim 19 is dependent on Claim 1 (and Claim 20 canceled as dependent on Claim 2), Claim 19 is patentable over the cited references for at least the reasons discussed above for independent Claim 1. Accordingly, it is requested that this rejection be withdrawn.

Claims 3 and 6

The Examiner also rejects Claims 3-6 under 35 U.S.C. §103 as being unpatentable over Sasaki et al. in view of Nakai et al. and further in view of Ito et al.

Independent Claims 3 and 5¹ require:

“forming an image for one frame image comprising 2^{m-n} subframes by performing voltage gray scale method and time ratio gray scale that uses only (m-n) bit at the same time,”

Applicants do not believe that any of these cited references disclose or suggest time ratio gray scale that uses only (m-n) bit. Hence, Claims 3 and 5 are not disclosed or suggested by the cited references. As Claims 4 and 6 have been canceled, it is requested that this rejection be withdrawn.

Claims 21-24

The Examiner also rejects Claims 21-24 under 35 USC §103 as being unpatentable over Sasaki et al. in view of Nakai et al. and further in view of Ito et al. and further in view of Mase et al. As Claim 21 is dependent on Claim 3 and Claim 23 dependent on Claim 5 (and Claims 22 and 24 canceled as dependent on Claims 4 and 6), Claims 21 and 23 are patentable over the cited references for at least the reasons discussed above for independent Claims 3 and 5. Accordingly, it is requested that this rejection be withdrawn.

Claims 7, 8, 13 and 14

The Examiner also rejects Claims 7, 8, 13 and 14 under 35 USC §103 as being unpatentable over Sasaki et al. in view of Nakai et al. and further in view of Ishida et al. As Claims 7 and 13 are dependent on Claim 1 (and Claim 8 and 14 canceled as dependent on Claim 2), Claims 7 and 13 are patentable over the cited references for at least the reasons discussed above for independent Claim 1. Accordingly, it is requested that this rejection be withdrawn.

¹ Claim 5 has also been amended to remove the limitation “an opposing substrate which comprises an opposing electrode;” as it is not believed to be necessary for the patentability of this claim.

Claims 9-12 and 15-18

The Examiner also rejects Claims 9-12 and 15-18 under 35 USC §103 as being unpatentable over Sasaki et al. in view of Nakai et al. and further in view of Ito et al. and further in view of Ishida et al. As Claims 9, 15 and 11, 17 are dependent on Claims 3 and 5 respectively (and Claims 10, 16 and 12, 18 canceled as dependent on Claims 4 and 6), Claims 9, 11, 15 and 17 are patentable over the cited references for at least the reasons discussed above for independent Claims 3 and 5. Accordingly, it is requested that this rejection be withdrawn.

Claims 49 and 50

The Examiner also rejects Claims 49 and 50 under 35 USC §103 as being unpatentable over Sasaki et al. in view of Nakai et al. and further in view of Kusano et al. As Claim 49 is dependent on Claim 1 (and Claim 50 canceled as dependent on Claim 2), Claim 49 is patentable over the cited references for at least the reasons discussed above for independent Claim 1. Accordingly, it is requested that this rejection be withdrawn.

Claims 51-54

The Examiner also rejects Claims 51-54 under 35 USC §103 as being unpatentable over Sasaki et al. in view of Nakai et al. and further in view of Kusano et al. As Claims 51 and 53 are dependent on Claims 3 and 5 respectively (and Claims 52 and 54 canceled as dependent on Claims 4 and 6), Claims 51 and 53 are patentable over the cited references for at least the reasons discussed above for independent Claims 3 and 5. Accordingly, it is requested that this rejection be withdrawn.

Therefore, it is respectfully submitted that all the §103 rejections have now been overcome.

New Claims

Applicants have also added new Claims 55-58. Each of these claims are also allowable over the cited references for the reasons discussed above.

No fee is believed necessary for these claims. If such a fee is due for these claims, please charge our deposit account 50/1039.

Conclusion

Applicants respectfully submit that the present application is now in a condition for allowance, and it is requested that it now be allowed.

If any further fee is due for this amendment, please charge our deposit account 50/1039.

Favorable reconsideration is earnestly solicited.

Respectfully submitted,

Date: October 23, 2002



Mark J. Murphy
Registration No. 34,225

COOK, ALEX, McFARRON, MANZO,
CUMMINGS & MEHLER, LTD.
200 West Adams Street; Suite 2850
Chicago, Illinois 60606
(312) 236-8500

Marked-up copy of the amendments made herein:

IN THE SPECIFICATION:

Please amend the specification at the paragraph at page 8, lns. 5-7: as follows:

display is made by conducting simultaneously the voltage gray scale and the time ratio[n]gray scale, and by forming one frame of image from 2^{m-n} subframes, and in that

IN THE CLAIMS:

Please amend the claims as follows:

1(Amended). A liquid crystal display device comprising:

an active matrix substrate comprising an active matrix circuit in which a plurality of pixel TFTs are disposed in a matrix and a source driver, and a gate driver that drive the active matrix circuit; and

an opposing substrate comprising an opposing electrode,
wherein the liquid crystal display device is characterized as:
performing display by optically compensated bend mode, and
conducting voltage gray scale method and time ratio gray scale at the same time by using n bit out of m bit digital data as information for voltage gray scale, and only (m-n) bit as information for time ratio gray scale, wherein m and n are positive numbers equal to or greater than 2 and satisfy $m > n$.

Cancel Claim 2

3(Amended). A liquid crystal display device comprising:

an active matrix substrate comprising an active matrix circuit in which a plurality of pixel

TFTs are disposed in a matrix and a source driver and a gate driver that drive the active matrix circuit;

an opposing substrate comprising an opposing electrode; and

a circuit which converts m bit digital video data inputted from the external into n bit digital video data and provides the n bit digital video data to the source driver, wherein m and n are positive numbers equal to or greater than 2 and satisfy $m > n$,

wherein the liquid crystal display device is characterized as:

forming an image for one frame image comprising 2^{m-n} subframes by performing voltage gray scale method and time ratio gray scale that uses only $(m-n)$ bit at the same time, and;

applying voltage which makes an orientation of liquid crystal to a bend orientation on starting display of the 2^{m-n} subframes.

Cancel Claim 4

5(Amended). A liquid crystal display device comprising:

an active matrix substrate comprising an active matrix circuit in which a plurality of pixel TFTs are disposed in a matrix and a source driver and a gate driver that drive the active matrix circuit;

[an opposing substrate which comprises an opposing electrode;] and

a circuit which converts m bit digital video data inputted from the external into n bit digital video data and provides the n bit digital video data to the source driver, wherein m and n are positive numbers equal to or greater than 2 and satisfy $m > n$,

wherein the liquid crystal display device is characterized as:

forming an image for one frame image comprising 2^{m-n} subframes by performing voltage gray scale method and time ratio gray scale that uses only (m-n) bit at the same time;

applying voltage which makes an orientation of liquid crystal to a bend orientation on starting display of the frame which comprises 2^{m-n} subframes.

Cancel Claim 6.

7. A liquid crystal display device according to claim 1, wherein the positive number m is 10 and the positive number n is 2.

Cancel Claim 8.

9. A liquid crystal display device according to claim 3, wherein the positive number m is 10 and the positive number n is 2.

Cancel Claim 10.

11. A liquid crystal display device according to claim 5, wherein the positive number m is 10 and the positive number n is 2.

Cancel Claim 12.

13. A liquid crystal display device according to claim 1, wherein the positive number m is 12 and the positive number n is 4.

Cancel Claim 14.

15. A liquid crystal display device according to claim 3, wherein the positive number m is 12 and the positive number n is 4.

Cancel Claim 16.

17. A liquid crystal display device according to claim 5, wherein the positive number m is 12 and the positive number n is 4.

Cancel Claim 18.

19. A rear projector which comprises 3 liquid crystal display devices according to claim 1.

Cancel Claim 20.

21. A rear projector which comprises 3 liquid crystal display devices according to claim 3.

Cancel Claim 22.

23. A rear projector which comprises 3 liquid crystal display devices according to claim 5.

Cancel Claim 24.

25. A front projector which comprises 3 liquid crystal display devices according to claim 1.
26. A front projector which comprises 3 liquid crystal display devices according to claim 2.
27. A front projector which comprises 3 liquid crystal display devices according to claim 3.
28. A front projector which comprises 3 liquid crystal display devices according to claim 4.
29. A front projector which comprises 3 liquid crystal display devices according to claim 5.
30. A front projector which comprises 3 liquid crystal display devices according to claim 6.
49. A notebook type personal computer which comprises a liquid crystal display device according to claim 1.

Cancel Claim 50.

51. A notebook type personal computer which comprises a liquid crystal display device according to claim 3.

Cancel Claim 52.

53. A notebook type personal computer which comprises a liquid crystal display device according to claim 5.

Cancel Claim 54

Please add the following new claims:

55(New). A liquid crystal display device comprising:

a first substrate;

a plurality of pixel thin film transistors disposed in a matrix form over the substrate;

a source driver operationally connected to said plurality of pixel thin film transistors;

an opposing substrate provided with an opposing electrode; and

a liquid crystal layer interposed between the first substrate and the opposing electrode, said liquid crystal layer having a p cell structure; and

a digital video data time ratio gray scale processing circuit, operationally connected to said source driver,

wherein a m bit digital video data inputted to the digital video data time ratio gray scale processing circuit is converted into an n bit digital video data for voltage gray scale while only (m - n) bit data of the m bit digital video data is used for time ratio gray scale.

56(New). The liquid crystal display device according to claim 55 wherein said liquid crystal display device is operated in an OCB mode.

57(New). A method of driving a liquid crystal display device comprising:

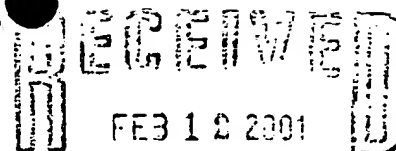
an active matrix substrate comprising an active matrix circuit in which a plurality of pixel TFTs are disposed in a matrix and a source driver, and a gate driver that drive the active matrix circuit; and

an opposing substrate comprising an opposing electrode,

wherein the method of driving the liquid crystal display device is characterized as:

performing display by optically compensated bend mode, and
conducting voltage gray scale method and time ratio gray scale at the same time by using n bit out of m bit digital data as information for voltage gray scale, and only $(m-n)$ bit as information for time ratio gray scale, wherein m and n are positive numbers equal to or greater than 2 and satisfy $m > n$.

58(New). A method of driving a liquid crystal display device comprising:
an active matrix substrate comprising an active matrix circuit in which a plurality of pixel TFTs are disposed in a matrix and a source driver and a gate driver that drive the active matrix circuit;
an opposing substrate comprising an opposing electrode; and
a circuit which converts m bit digital video data inputted from the external into n bit digital video data and provides the n bit digital video data to the source driver, wherein m and n are positive numbers equal to or greater than 2 and satisfy $m > n$,
wherein the method of the liquid crystal display device is characterized as:
forming an image for one frame image comprising 2^{m-n} subframes by performing voltage gray scale method and time ratio gray scale that uses only $(m-n)$ bit at the same time, and;
applying voltage which makes an orientation of liquid crystal to a bend orientation on starting display of the 2^{m-n} subframes.



COOK, ALEX, MCGARRON,
FANEO, CUMMINGS & MILLER

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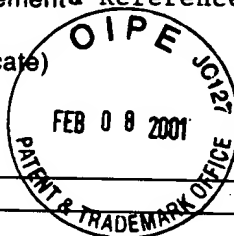
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RE: APPLICATION

ATTY/SEC: MJM/cn

File no: SEL 169

Applicant: Shunpei YAMAZAKI et al

S.N.: 09/534,812 Filing Date: March 24, 2000

Title: Liquid Crystal Display Device

Due date: _____ Date Sent: 2/6/2001